A meta-analysis of acupuncture techniques for smoking cessation

Adrian R White, Karl-Ludwig Resch, Edzard Ernst

Abstract

Objective—To determine the effectiveness of acupuncture for smoking cessation and to examine whether any individual aspect of trials is associated with an effect.

Data sources—All randomised controlled trials of acupuncture for smoking cessation that were listed in computerised databases or reference lists of relevant articles.

Study selection—All randomised single-blind studies that compared acupuncture with sham acupuncture.

Data extraction—Methodological data were extracted for quality assessment. Outcome data were extracted for rates of total smoking cessation at three intervals: early after treatment and after six and 12 months follow up.

Data synthesis—Results were expressed as odds ratios of success over failure in intervention over control groups. The combined odds ratio for all studies was calculated. Repeated meta-analyses were subsequently performed on subsets of studies combined according to defined characteristics: acupuncture technique, number of attendances, country of origin, status of journal, and control procedure. The overall quality of studies was poor. The combined odds ratio for smoking cessation calculated for the earliest results after the end of treatment was 1.20 (95% confidence intervals (95% CIs) = 0.98 to 1.48). The combined odds ratio for smoking cessation after six months was 1.29 (95% CI = 0.82 to 2.01), and after 12 months was 1.03 (95% CI = 0.73 to 1.46). There were no significant effects of relevance among subsets of studies grouped according to defined characteristics.

Conclusions—Acupuncture was not superior to sham acupuncture for smoking cessation; no particular aspect of acupuncture technique was associated with a positive effect. The conclusions are limited by methodological inadequacies of studies and by the absence of testable hypotheses; design of future trials should avoid these deficiencies.

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Department of Complementary Medicine, Postgraduate Medical School, University of Exeter, Exeter, UK
A R White
K-L Resch
E Ernst

Correspondence to:
Department of Complementary Medicine, Postgraduate Medical School, University of Exeter, 25 Victoria Park Road, Exeter EX2 4NT;
a.r.white@exeter.ac.uk

Introduction

It has been estimated that up to 16% of residents in the United Kingdom have used acupuncture at some time,[1] and a recent survey found that 15% of the population would consider complementary medicine for smoking cessation.[2] The use of acupuncture for addictions originated from a chance observation that opiate withdrawal symptoms were relieved among Hong Kong addicts who received acupuncture treatment.[3] Subsequent studies in animals that had been rendered dependent on drugs lent some support to the idea that acupuncture may have an effect on withdrawal symptoms.[4–7]

Acupuncture has been considered for a role in smoking cessation because of its effects in releasing neurotransmitters. Details of these effects in humans are still unclear, as indeed are the neurochemical mechanisms of nicotine addiction and withdrawal. In addition to evidence that acupuncture may release endogenous opioids,[8] there is some evidence suggesting a possible role for serotonin (5-HT), noradrenaline (norepinephrine), and cholecystokinin in acupuncture analgesia.[8 9] as well as in nicotine craving and withdrawal.[10] It seems likely that increased dopamine levels (through inhibition of monamine oxidase inhibitor B) are involved in nicotine addiction[11] but the role of acupuncture in dopamine metabolism is still uncertain.[8]

There is contradictory evidence on whether acupuncture has a clinically useful effect in smoking cessation. In one review, Lewith[12] concluded that "acupuncture is as good as nicotine replacement therapy." On the other hand, ter Riet *et al*[13] performed a criteria-based, systematic review of randomised controlled trials (RCTs) and concluded that better quality studies were more likely to be negative. Two further meta-analyses[14 15] concluded that there was no evidence that acupuncture had an effect in smoking cessation. However, these analyses involved only eight and six studies respectively, and may be open to bias as they included open trials. The range of techniques used in these trials was wide, and the possibility remains that one technique may be more effective than another.

Two basic acupuncture techniques are reported. Firstly, needles may be inserted while the patient relaxes for 10 to 20 minutes. The needles are then removed. Points in the ear are commonly used in the English-speaking world, whereas French practitioners more commonly use points in the face. Acupuncture points on the body may be needled at the same time, and electrical stimulation may be applied. Secondly, an indwelling needle may be inserted into one or more points in the ear and held in

place for one or two weeks with an adhesive dressing. The subject is instructed to press the needle whenever cravings occur. The number and frequency of treatments vary between practitioners.

We conducted a fresh meta-analysis of RCTs, using a comprehensive search strategy, to determine the effectiveness of acupuncture in smoking cessation and to compare the effectiveness of different techniques.

Methods

DATA SOURCES

A literature search was performed of computerised databases held by Medline (1974–1996), Embase, the British Library, CISCOM (Centralised Information Service for Complementary Medicine, Royal College of Complementary Medicine, 60 Great Ormond Street, London WC1N 3JF), and Science Citation Index, combining the terms "clinical trials", "acupuncture", and "smoking" or "tobacco". Previous reviews of acupuncture for addiction were obtained and their reference lists searched. The results of contacting experts in the field and searching for "grey" literature, performed for one recent review,[13] were included, but the procedures were not repeated. Copies of original articles were obtained and, where necessary, authors were contacted to obtain further data or clarify details.

STUDY SELECTION

All studies were selected in which subjects were randomised by an appropriate method to receive acupuncture or a control intervention. Only subject-blind studies, in which the control group received a sham form of acupuncture, were included in the primary analyses. However, all studies were included in the comparison of acupuncture with different control procedures. There were no restrictions on acupuncture technique or length of follow up, but only studies published in English, French or German were included.

DATA EXTRACTION

The outcome measure used in the analysis was complete cessation of smoking at three time points: the earliest measurement after the intervention, and after six and 12 months, follow up. Participants' reports of smoking cessation were used as biochemical confirmation was not available in any of the studies. Where necessary, results were recalculated to include all drop-outs, who were assumed to have relapsed. Sustained cessation rates were used when available in preference to point prevalence of abstinence.

QUALITY ASSESSMENT

Each paper was first assessed for appropriateness of method of randomisation, concealment of randomisation, minimisation of practitioner interaction, and sample size calculation. Each study was then scored according to the method of ter Riet *et al* [13] using a list of 18 predefined criteria which included validation of outcome and duration of follow up. The maximum possible score is 100. The original authors allocated points to each criterion according to their estimate of its importance, the highest score being 15 points for "Good quality of acupuncturist mentioned." Examples of other criteria were randomisation (12), adequate description of acupuncture procedure, subject-blinding, and at least 50 subjects in each group (10 points each).

DATA SYNTHESIS

The data were analysed using custom-written software known as RevMan 2.1a. This programme was developed and published by the Cochrane Collaboration to provide accessible and standardised methods of performing meta-analyses for the Cochrane database of systematic reviews. It provides the facility of performing repeated meta-analyses on various combinations of studies which have been selected according to defined criteria. In the present study, total numbers of subjects included in each group, and the numbers who

Table 1   Details of random controlled trials of acupuncture for smoking cessation

Author	n	Treatment	Sustained treatment	Control procedure(s)	Duration of follow up
Sham-controlled RCTs					
Clavel[19]	996	Facial (+ nicotine/placebo gum)	NA	Sham (+ nicotine/placebo gum)	13 months
Gilbey[21]	92	Auriculo	i.n.	Sham	3 months
Gillams[22]	81	Auriculo	i.n.	(a) Sham	6 months
				(b) Behaviour	
Lacroix[24]	117	Face	NA	Sham	2 weeks
Lagrue[25]	154	Face	NA	Sham	
Lamontagne[26]	75	Auriculo	NA	(a) Body, for relaxation	6 months
				(b) Waiting list	
Martin[29]	134	(a) Auriculo	i.n.	(a) Sham	6 months
	126	(b) Auriculo + EA		(b) Sham	
Parker[30]	21	(a) Auriculo	i.n.	(a) Sham	6 weeks
	20	(b) Auriculo + EA		(b) Sham	
Steiner[31]	22	Body + auriculo	i.n.	Sham	4 weeks
Vandevenne[32]	200	Face + body	NA	Sham	12 months
RCTs using other controls					
Clavel[17]	665	Facial	NA	(a) Nicotine gum	13 months
				(b) Timed cigarette case	
Cottraux[20]	558	Auriculo + facial	NA	(a) Behaviour	12 months
				(b) Placebo	
				(c) Waiting list	
Labadie[23]	130	Auriculo + face + body	NA	Medical	12 months
Leung[27]	95	Auriculo	i.n.	(a) Behaviour	6 months
				(b) Waiting list	

EA = electroacupuncture; i.n. = indwelling needle.
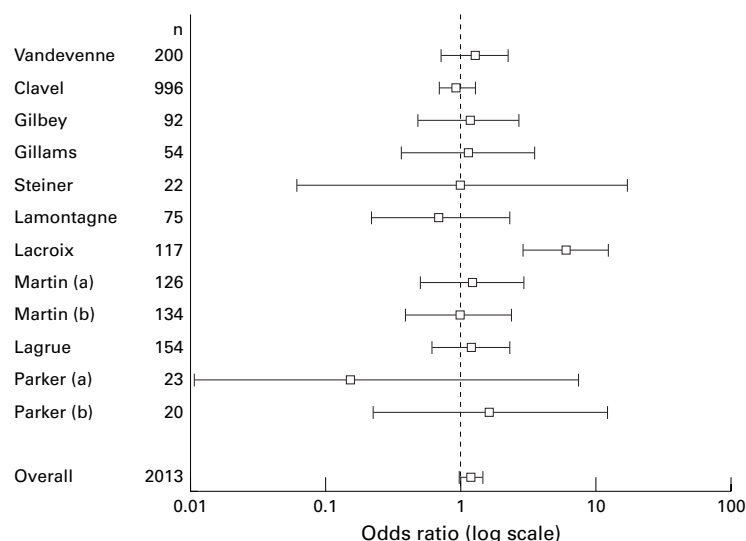NA = not applicable.

Figure 1   Odds ratios and 95% confidence intervals for smoking cessation at first assessment after intervention for individual and overall odds ratio. Trials in descending order of quality. n = Number of subjects. Martin and Waite,[29] and Parker[30] included separate trials in the reports, labelled (a) and (b) in the figure.

had stopped smoking at specified time intervals (first measure, six months, 12 months) were entered into tables for comparison. Subsequently all studies were allocated to subgroups according to the following characteristics: acupuncture technique, number of attendances, country of origin, status of journal of publication, and control procedure.

The method of analysis selected for this study calculated the odds ratio (OR) for each trial, that is, the ratio of successes to failures in the genuine treatment group, divided by the same ratio in the sham treatment group, presented on a logarithmic scale. Weighting studies according to their inverse variance, the programme computed a combined OR for all trials in the comparison, using the Peto model developed from the Mantel-Haenszel approach.[16] This method does not involve any assumptions and patients in one trial are only compared with other patients in the same trial. 95% Confidence intervals (CIs) were calculated from the sums of the individual variances.

Results

Fourteen reports of RCTs of acupuncture for smoking cessation were found.[17–32] We have been unable to obtain a copy of an unpublished study by Tschopp which was included in the review by ter Riet *et al*. [13] Previous reviews include a study by Machovec and Man.[28] However, the report does not state that the subjects were randomised and as we were unable to clarify this point with the authors, this study was excluded. Key information from all remaining RCTs is set out in table 1.

There were 10 reports of studies in which the control group received some form of sham acupuncture, as set out in table 1. However, Martin and Waite[29] and Parker and Mok[30] reported two comparisons (two groups receiving different acupuncture procedures, each with its own control group). Data from each of these studies were entered separately. Thus the

main analyses included 12 sham-controlled, subject-blinded RCTs. Additional data for the study by Martin and Waite[29] were obtained from the authors.

Figure 1 gives the ORs for smoking cessation for all studies at the first assessment after the intervention. The combined OR for smoking cessation in the 12 studies was 1.20 (95% CI = 0.98 to 1.48). The combined OR for smoking cessation after six months was 1.29 (95% CI = 0.82 to 2.01). The two studies that followed up subjects for 12 months produced a combined OR of 1.03 (95% CI = 0.73 to 1.46).

QUALITY OF STUDIES
The overall quality of the studies was disappointing. A particular deficiency was the failure to validate smoking cessation by biochemical tests, relying instead on subjects' reports. Other consistent methodological problems were as follows. No report included adequate details to be certain whether an appropriate method of randomisation with adequate concealment was used. No attempt to minimise the influence of the acupuncturist on the subjects was mentioned in 12 of the 14 reports: Gilbey and Neumann[21] reported minimal interaction by the therapist, and Lacroix and Besancon[24] arranged for the therapist to be blinded. Although sustained cessation is the aim of any anti-smoking programme, the outcome at six months was measured in only four studies, and at 12 months in only two studies (table 2). A sample size calculation, which should be an essential part of trial design, was only mentioned by Clavel *et al*.[18]

The lack of methodological rigour is indicated by the quality scores assessed by the method of ter Riet *et al* [13] and shown in table 2. Studies are presented in descending order of quality in figure 1, and it can be seen that there is no meaningful relation between quality and result. The combined OR for the six better-quality studies which scored 50 points or more was 1.02 (95% CI = 0.80 to 1.31).

On repeating the quality assessment using the criteria of ter Riet *et al*,[13] we found that these authors had awarded the study by Lacroix[24] zero points for technique. However, there are clear indications in the text that the acupuncturist was of good quality. These details were given in technical language which was presumably not recognised by ter Riet and

Table 2   Sham-controlled random controlled trials of acupuncture for smoking cessation: quality scores (method of ter Riet et al[13]) and assessment intervals

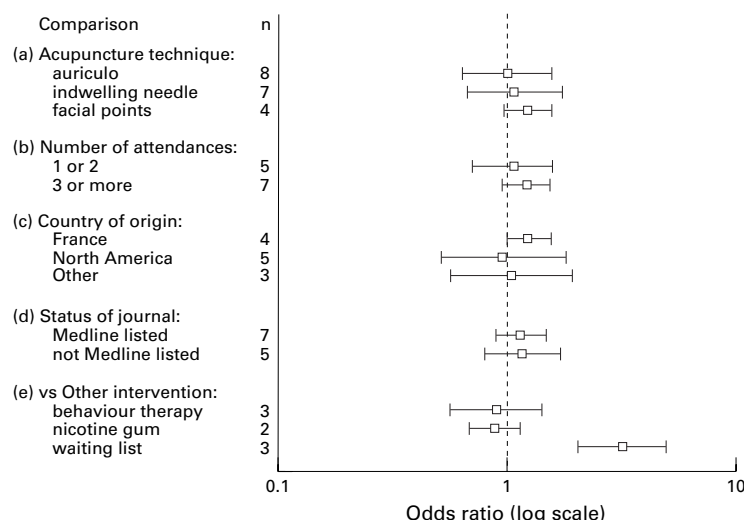| First author	Quality score	Outcome measurement intervals analysed		
		Earliest interval (weeks)	6 Months	12 Months
Vandevenne[32]	74	6	+	+
Clavel[19]	62	4		+
Gilbey[21]	59	1		
Gillams[22]	57	4	+	
Steiner[31]	52	4		
Lamontagne[26]	50	2	+	
Lacroix[24]	47	2		
Martin[29]	41	3	+	
Lagrue[25]	40	1		
Parker[30]	34	6		

Figure 2 Odds ratios and 95% confidence intervals for smoking cessation at first assessment after intervention for subgroups of sham-controlled random controlled trials of acupuncture. Comparisons (a) to (d) include sham-controlled studies; comparison (e) includes all randomised studies. n = Number of subjects.

colleagues, none of whom were acupuncturists. This study had been underscored by 25 points. (We would argue that the opinion of a specialist in the area should be consulted when assessing the quality of experience or technique.)

OTHER COMPARISONS

Figure 2 shows that no particular aspect of the studies was identified which led to a result in which acupuncture was superior to sham, whether combining studies with different acupuncture techniques, number of attendances, country of origin, or status of journal. The comparisons with other control groups were limited by small numbers of studies. Acupuncture appears to be as effective for smoking cessation as behaviour therapy,[20 22 27] but significantly better than waiting-list control[20 26 27] which, in view of the lack of specific effects shown above, provides evidence of its considerable placebo effect. However, this effect may not persist: after six months there was no difference in outcome (OR 0.99, 95% CI = 0.30 to 3.20).

Discussion

In our analyses, no acupuncture technique was shown to be have greater efficacy than sham acupuncture for smoking cessation. This is consistent with previous meta-analyses.[14 15] These studies are burdened by methodological inadequacies. A particularly critical limitation was the failure to validate smoking cessation. Other potentially serious sources of bias include inadequate details of randomisation procedures and failure to minimise practitioner influence on the subjects. It is noteworthy that the six studies which made the best attempts to reduce bias, and scored 50% or more on formal quality testing, also confirmed the lack of efficacy of acupuncture for smoking cessation. Thus the overall negative finding of the present study is likely to be valid.

The problem of the unreliability of the results can be illustrated by considering the

single study[24] which was strongly positive compared with the remaining 11. This result cannot be explained by the variables examined here, such as acupuncture technique. However, the report did not mention any attempt to minimise or standardise the practitioner's influence on patients. Therefore it seems possible, or even likely, that therapist bias contributed significantly to this positive result.

Acupuncture did prove to be more effective than waiting-list control and therefore appears to have important non-specific effects. Members of the public are likely to continue to approach practitioners for help in stopping smoking while the current interest in acupuncture lasts. Indeed, their preference for this particular form of treatment, the effort of finding a practitioner, and the commitment of paying a fee might usefully increase the motivation to stop.

This review has highlighted the variety of styles of acupuncture which have been tested for smoking cessation, reflecting the absence of any clear hypothesis on the role of acupuncture in smoking cessation, either at mechanistic or behavioural level. Most studies were based empirically on the findings of previous reports. Only one study[29] was stated to have been designed to test a possible mechanism of action of acupuncture—the release of endogenous opioids, for which there is some evidence.[33] Although endogenous opioids may be relevant to withdrawal from opiate drugs, their role in nicotine withdrawal is much less certain. On the other hand, there is little evidence that acupuncture influences the level of dopamine which appears to be fundamental to the process of nicotine addiction.[11]

No study was based on a hypothesis that acupuncture might have particular behavioural effects that might assist smoking cessation, for example, by reducing withdrawal symptoms, by inducing euphoria or by increasing motivation and thereby reducing the relapse rate. Data on craving were only presented in one report[18] in which 318 out of the total of 996 subjects assessed their need for a cigarette after the intervention as a secondary outcome measure. The results do not suggest any influence of either nicotine chewing gum or acupuncture on levels of craving.

There remains the question whether all potential contributions of acupuncture in nicotine dependence have been explored. This study did not uncover evidence that any particular technique of acupuncture was more promising than any other, although the strength of this conclusion is limited by the small number of studies. There were trends in favour of using facial points and of repeating treatment on three or more occasions. These trends hardly amount to a hypothesis for the action of acupuncture on either the neurochemical or the behavioural level which would justify further research at the present time.

It is axiomatic that, if further research into acupuncture for smoking cessation is conducted, this should be to a much higher

standard of quality than previously. In addition to the need for a clear hypothesis, the major methodological requirements identified are: calculation and recruitment of adequate sample size, appropriate method of randomisation of subjects, concealment of randomisation, minimisation of therapist bias, biochemical validation of smoking cessation, and long-term follow up for at least six months and preferably 12 months.

In conclusion, even the most rigorous trials provide no evidence that acupuncture is superior to sham in smoking cessation. There is also no evidence that one acupuncture technique is superior to another.

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